

1           A HANDHELD DEVICE WITH INTEGRAL AXIAL CAMERA

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3           BACKGROUND OF THE INVENTION

4           1.       Field of the Invention

5           The present invention relates generally to handheld devices, and more  
6           particularly toward incorporating a camera into a handheld device.

7           2.       Discussion of Background Art

8           Handheld devices, such as Personal Digital Assistants (PDAs), are information  
9           appliances geared toward mobile users. They have been evolving very quickly as  
10          users are demanding, and manufacturers are adding, new features and functionalities  
11          at an increasing pace.

12          Basic handheld devices are commonly used for maintaining personal  
13          information, such as schedules, lists of names and phone numbers, performing basic  
14          calculations, and note taking. However some enhanced handheld devices may further  
15          include: a cell phone, modem, a wireless connection, e-mail, and Web browsing  
16          capabilities. Most have tiny keyboards, while others include touch pads.

17          Many of the enhanced handheld features, however, have been hastily added,  
18          and thus tend to be unrefined, bulky, and difficult to use. For example, recent  
19          handhelds have included a still camera as a next "must have" feature. These cameras  
20          tend to be tacked wherever there is space left, but often are very awkward to use  
21          and/or have limited capabilities.

22          In response to the concerns discussed above, what is needed is handheld  
23          computer that overcomes the problems of the prior art.

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SUMMARY OF THE INVENTION

2       The present invention is a handheld device with integral axial camera. The  
3       apparatus of the present invention includes: a top portion; a bottom portion; a hinge,  
4       rotational about a first axis and having a first end and a second end, coupling the top  
5       portion to the bottom portion; and an image capture device, coupled to the first end of  
6       the hinge and oriented to capture images aligned along the first axis of the hinge.

7       The method of the present invention includes: permitting a first large screen  
8       interface to rotate about a first hinge axis with respect to a second large screen  
9       interface; capturing images aligned along the first hinge axis; and setting a mode in  
10      which the device operates in response to an orientation of the first large screen  
11      interface to a second large screen interface.

12       These and other aspects of the invention will be recognized by those skilled in  
13      the art upon review of the detailed description, drawings, and claims set forth below.

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**BRIEF DESCRIPTION OF THE DRAWINGS**

2       Figure 1 is a first pictorial diagram of one embodiment of a handheld device;  
3       Figure 2 is a second pictorial diagram of the one embodiment;  
4       Figure 3 is a third pictorial diagram of the one embodiment;  
5       Figure 4 is a fourth pictorial diagram the one embodiment;  
6       Figure 5 is a fifth pictorial diagram the one embodiment; and  
7       Figure 6 is a flowchart of one embodiment of a method of operation for the  
8       device.

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1           DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

2           The present invention ergonomically incorporates an image capture device into  
3        a hand held device. By placing image capture and display devices axially within the  
4        handheld device's hinge, the present invention permits users to capture and view  
5        images under any lighting condition, while holding the device in a natural and  
6        ergonomically friendly manner, and even when the device is in a folded orientation.  
7        Such an axial location also permits a variety of aftermarket lenses and filters to be  
8        attached to the image capture device for better viewing. Also the relatively long  
9        length of the hinge permits optical lenses to translate along the axis for telephoto or  
10      wide angle image captures.

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12          Figure 1 is a first pictorial diagram 100 of one embodiment of a handheld  
13        device 102. Figure 2 is a second pictorial diagram 200 of the one embodiment.  
14        Figure 3 is a third pictorial diagram 300 of the one embodiment. Figure 4 is a fourth  
15        pictorial diagram 400 the one embodiment. And, Figure 5 is a fifth pictorial diagram  
16        500 the one embodiment. Figures 1 through 5 are discussed together.

17          The handheld device 102 preferably falls into a class of devices known as  
18        Personal Digital Assistants (PDAs), and thus preferably provides certain computing  
19        and information storage and retrieval functionalities common to the class. Alternative  
20        embodiments of the present invention, however, could be embodied within other types  
21        of hinged apparatus, such as cell phones, a laptop computers, notepads, or even items  
22        of luggage.

23          The device 102 includes a hinge 104 which permits a top cover 106 to rotate  
24        about a first axis (A) 107 with respect to a bottom cover 108. The hinge 104 includes  
25        a first end 110, and a second end 111 both affixed to the bottom cover 108, and a  
26        middle portion 112 affixed to the top cover 106. The middle portion 112 includes a

1 sub-hinge 114, which permits the top cover 106 to rotate about a second axis (B) 115  
2 with respect to the bottom cover 108. Those skilled in the art recognize that there are  
3 an unlimited number of orientations of the top cover 106 with respect to the bottom  
4 cover 108 about the hinge 104 and sub-hinge 114.

5 Rotation of the top and bottom covers 106 and 108 with respect to each other  
6 automatically determines a mode in which the device 102 operates. These modes  
7 include: a “first image capture mode,” a “first handheld mode,” a “second image  
8 capture mode,” and a “second handheld mode.” A preferred method for determining  
9 when each mode is entered and what effect each mode has on the device 102, is  
10 described below with respect to Figure 6. Those skilled in the art however recognize  
11 that while the modes describe are preferred, they can be varied for different  
12 implementations of the present invention.

13 The hinge 104 also includes an image capture device 116 located within the  
14 first end 110 and a small screen interface 118 located within the second end 111 of the  
15 hinge 104. The image capture device 116 includes a light sensitive sensor for  
16 acquiring optical information, and one or more lenses for focusing optical light on the  
17 light sensitive device. Some embodiments of the image capture device 116 include  
18 multiple lens which can translate with respect to each other, so as to provide an optical  
19 zoom capability. Additional lenses and/or filters (not shown) may also be attached to  
20 the image capture device 116 to provide for enhanced image capture capabilities. The  
21 small screen interface 118 is preferably capable of displaying both captured images  
22 (either in real-time like a viewfinder or which have been previously recorded) and any  
23 other information generated by the device 102. Both the image capture device 116  
24 and the small screen interface 118 are preferably aligned along the hinge’s axis of  
25 rotation so that users may simultaneously capture and view images when the top and  
26 bottom covers 106 and 108 of the device 102 are closed.

1           The bottom cover 108 includes a telephoto (T) and wide-angle (W) zoom  
2       control 120 beneath the small screen interface 118 and a shutter control 122 beneath  
3       the image capture device 116. The zoom control 120 provides for an optical and/or  
4       digital zoom feature, and the shutter control 122 instructs the device 102 to capture  
5       one or more images (i.e. a still picture or a video clip) using the image capture device  
6       116. The bottom cover 108 also includes a bottom large screen interface 124 and a  
7       touch sensitive pad 126. The bottom large screen interface 124 is at a minimum  
8       preferably capable of receiving input commands from users of the device 102, but  
9       may also display any information generated by the device 102, including captured  
10      images. The bottom large screen interface 124 preferably accepts a pen inputs, while  
11      user selections are made with the touch sensitive pad 126. In alternate embodiments,  
12      the bottom large screen interface 124 may be wholly replaced with another input  
13      device, such as a keyboard or touch sensitive pad.

14           The top cover 106 includes a top large screen interface 128 and a set of  
15      selection buttons 130. The top large screen interface 128 preferably functions as an  
16      image display for either captured images or other information generated by the device  
17      102. However, since the top cover 106 can be rotated and flipped back onto the  
18      bottom cover 108 such that the top large screen interface 128 faces away from the  
19      bottom large screen interface 124, the top large screen interface 128 preferably can  
20      also accept user inputs so that the device functions as a tablet computer.

21           Other features of the device 102 include: a sound capturing device, so that  
22      sounds may be recorded by the device 102 along with images; a biometric fingerprint  
23      recognition pad 132 for unlocking the device 102; wireless phone and networking  
24      capabilities; and spatial locational device.

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1       Figure 6 is a flowchart 600 of one embodiment of a method of operation for  
2 the device. The method begins in step 602 where the device 102 identifies a current  
3 orientation of top and bottom covers 106 and 108, and top and bottom large screen  
4 interfaces 128 and 124.

5       Next in step 604, the device 102 enters a “first image capture mode” and  
6 displays information on the small screen interface 118, if the top cover 106 is folded  
7 onto bottom cover 108, and top and bottom large screen interfaces 128 and 124 are  
8 facing each other. Figures 1, 3 and 4 show the device in the “first image capture  
9 mode.” In this mode, users are capturing images with the image capture device 116  
10 while looking through the small screen interface 118 at what is being captured. Users  
11 may prefer this mode out of convenience or due to bright lighting conditions which  
12 would otherwise obscure images displayed on one of the large screen interfaces 124  
13 and 128.

14       In step 606, the device 102 enters a “first handheld mode” and displays  
15 information on the top large screen interface 128 in a first (preferably portrait)  
16 orientation, if the top cover 106 is not folded onto the bottom cover 108, and there is  
17 less than +/- 45 degrees of rotation about the sub-hinge 114 with respect to home  
18 position. The home position is herein preferably defined as the orientation of the top  
19 and bottom covers 106 and 108 about the sub-hinge 114 as shown in Figure 2. Figure  
20 2 shows the device in the “first handheld mode.” In this mode, users are primarily  
21 using the device 102 as a handheld PDA, whereby commands and inputs are received  
22 on the bottom large screen interface 124 and information is displayed on the top large  
23 screen interface 128.

24       In step 608, the device 102 enters a “second image capture mode” and displays  
25 information on the top large screen interface 128 in a second (preferably landscape)  
26 orientation, if top cover 106 is not folded onto bottom cover 108, and there is more

1 than +/- 45 degrees of rotation about the sub-hinge 114 with respect to the home  
2 position. Figure 5 shows the device in the “second image capture mode” after the top  
3 cover 106 has been rotated approximately 90 degrees about the sub-hinge 114. In this  
4 mode, users are capturing images with the image capture device 116 while looking  
5 through the top large screen interface 128 at what is being captured. Users may prefer  
6 this mode when viewing images on the top large screen interface 128 would be more  
7 convenient than viewing them on the small screen interface 118.

8       Then in step 610, the device 102 enters a “second handheld mode” and  
9 displays information on the top large screen interface 128 in a third (preferably  
10 portrait) orientation, if top cover 106 is folded onto the bottom cover 108, and the top  
11 and bottom large screen interfaces 128 and 124 are facing away from each other. The  
12 third orientation is upside-down with respect to the first orientation. This mode is not  
13 shown in the Figures, however, in this mode, users are primarily using the device 102  
14 as a handheld tablet computer, whereby commands and inputs are received and  
15 information is displayed on the top large screen interface 128.

16       Those skilled in the art will know that the values given for degrees of rotation,  
17 home position, image orientation, and information displayed and/or received on the  
18 screen interfaces, as discussed herein are preferred but not required. Other  
19 embodiments of the present invention may vary these elements to fit any particular  
20 design. Such other embodiments can perhaps include replacing the “second handheld  
21 mode” in step 610 with a “simultaneous handheld and image capture mode” which  
22 displays information on both the top large screen interface 128 and the small screen  
23 interface 118, when the top cover 106 is folded onto the bottom cover 108, and the top  
24 and bottom large screen interfaces 128 and 124 are facing away from each other.

25       Next in step 612, the device 102 adjusts zoom of the image capture lens 116 in  
26 response to user command (e.g. rocking the zoom control 120). And in step 614, the

1 device 102 captures a set of image in response to user command (e.g. pressing the  
2 shutter button 122).

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4 While one or more embodiments of the present invention have been described,  
5 those skilled in the art will recognize that various modifications may be made.  
6 Variations upon and modifications to these embodiments are provided by the present  
7 invention, which is limited only by the following claims.